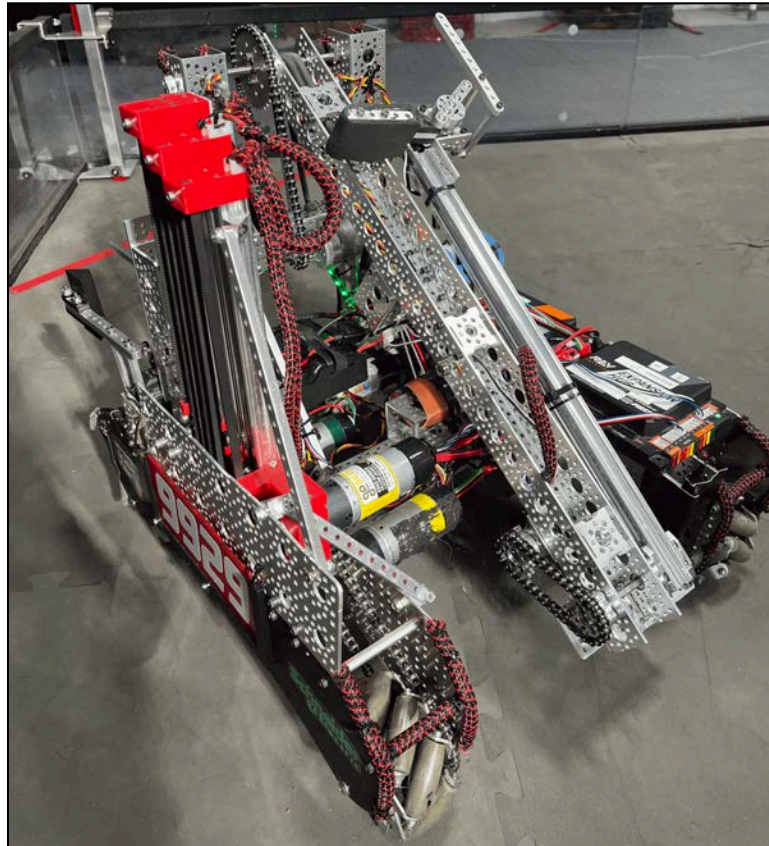# FTC#9929
Tech Ninja Team

Engineering Portfolio
2024/2025

Team Overview

Hello! We are Tech Ninja Team (TNT) FTC#9929, a community team from Homewood-Flossmoor, Illinois.

We work out of an old funeral home which is now the Homewood Science Center. Our workshop is in the garage where they used to park the hearses!

|	
	Hi my name is Kammi 3rd year Gymnastics, diving, ref soccer One thing that I like about FTC is building
	Hi my name is Ian This is my 2nd year in FTC I like to draw and read I am a Freshman One thing about FTC that I enjoy is 3D printing I play soccer I got introduced into FTC by looking next door at the robots when I was in FLL and saw how cool it was and got inspired to join the next year I am a driving coach
	Salutations judges my name is Surendran This is my 4th year doing FTC I like to play basketball, go on bike rides, help out the community, and socialize with my friends. I am a Sophomore Things I enjoy about FTC are spending time with my teammates. I like coding and find it very useful in school during my engineering class. I play volleyball I learned about FTC from when my brother was the operator in previous years and I saw him operating and was inspired by that and wanted to join the team to try it for myself

	Wassup my name is Trevor This is my 4th year doing FTC I have a youtube channel and spend time making youtube shorts, I also help with little kids at my sisters elementary school and ref kids soccer games. I am a Sophomore I enjoy being the driver of the robot the robot I play basketball volleyball and soccer I learned about FTC from when my sister was the driver in previous years and I saw her driving and was inspired by that and wanted to join the team to try it for myself
	Hi my name is Liam This is my 1st year doing FTC I like piano I am an 8th grader My favorite thing about FTC is being able to learn new stuff able to code and make new friends I play golf I heard about FTC from elementary school but in that club I didn't want to code there, so when I was in 7th grade I learned about FTC and decided to join this year
	Hi my name is Marcus This is my 3rd year in FTC I like playing basketball, Video games, playing sudoku, and hanging out with friends. I am a Sophomore enrolled enrolled HF highschool My favorite thing about building the robots, coding and working with CAD Run track and field I did First Lego League (FLL) and I would come to practice and see older people working on bigger robots and got interested so I decided to join the team I am human player and like helping the team during matches
	Hi my name is Ezra This is my 3rd year in FTC I enjoy playing Nintendo video games and work with electronics for theater Things I like about FTC are being able to learn more about how electronics work and robotics work, and being able to apply the skills I've learned to the outside world. I am a Freshman I did FLL and was always into stem so when I would come to homewood science center I would be able to see the team practicing and thought it was interesting. I am a driving coach

How we work

Many FTC teams divide and conquer when working, some may stay in one group, like a building group or programming group, their entire season. But we have another method, we have decided to let everyone work on everything! This allows for everyone to be well-rounded in designing, building, programing and redesigning! In order to maximize efficiency, we use the design process.

```
Identify → Brainstorm → Prototype → Evaluate → Design → Fabricate
```
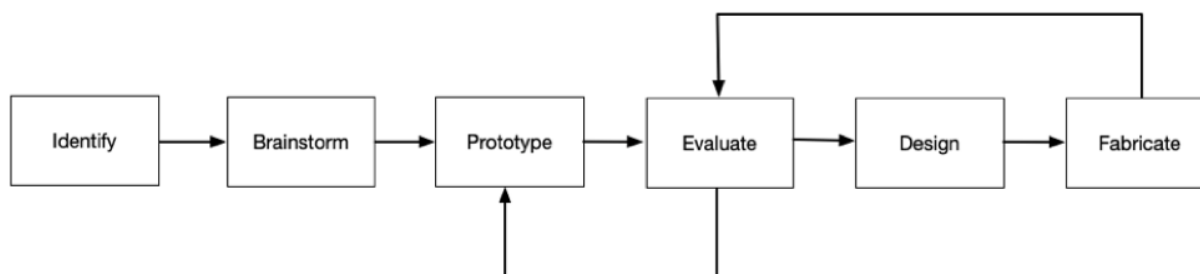
· Identify – identify the problem to be solved
· Brainstorm – brainstorm solutions
· Prototype – quickly build physical or mathematical models to evaluate the brainstormed solutions
· Evaluate – run experiments to see if the solution works
· Design – design a solution to use on the robot based on the prototype(s) and the evaluation
· Fabricate – machine, assemble or program the solution that was designed. Evaluate whether it meets the requirement.
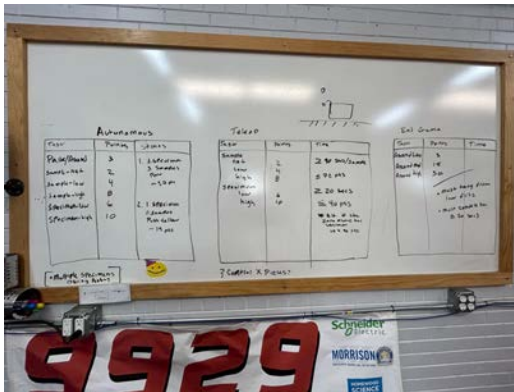
Strategy

We met during kick-off weekend, and began to strategize on how we should take on these new challenges.

Auto Strategy

1. We started figuring out our possible strategies by finding all possible solutions to the autonomous challenge. (all of the best ways to score.)
2. We determined that the best thing to do is score a specimen on the high bar and park if we can.
3. To polish our strategy we decided to have the robot change its angle to finish with the gripper facing samples on the field before the Tele-op so we can score more when Tele-op starts.

Tele-op Strategy

● We determined our strategy options for tele-op in a similar way to our auto strategy, we decided to primarily score by hanging specimens until we realized that we can more efficiently score with our arm when scoring on the high bucket.

● We determined that we would base our strategy off of our flexibility on strategy. When alliance partners were specializing in obtaining samples or scoring by hanging the specimens, we scored on the high bucket, and when our alliance partner specialized in scoring the samples in the high bucket, we scored by hanging the specimens.

● We knew we wanted to be this all around team since we were really reliable in both scoring the samples into the high bucket as well as being very reliable in hanging the specimen.

Overall Strategy

● For Auto we ultimately decided score by hanging the the specimens and preparing for Tele-op

● For Tele-Op we decided to focus on quick scoring, and flexibility on strategies to optimize the efficiency of our teams gameplay

Work Style

Work space

We have been working in a building that used to be a funeral home and is called, "The Homewood Science Center", they have been sponsoring us for an extended period of time and so, we were able to become very at home with our space making use of every corner of the workshop.
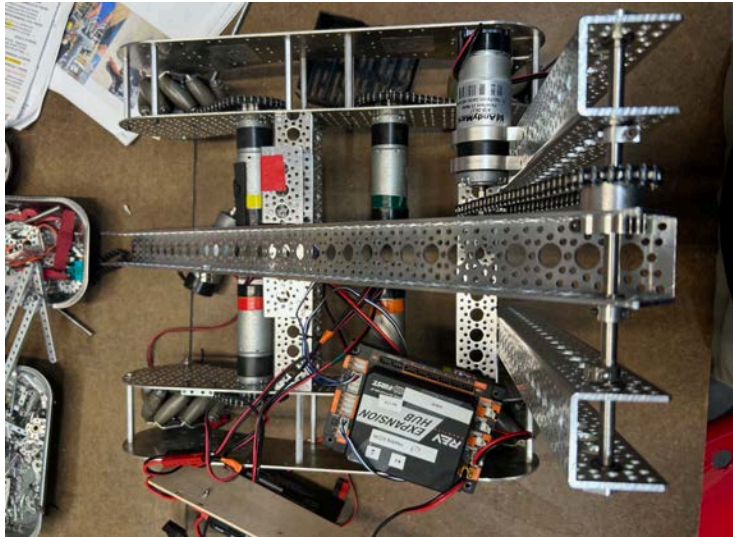
Workload
- We have 2 definite practice days: Thursday and Sunday, but we still have office hours any day of the week, when our mentors are able to overlook our practices.
- We have white boards in order to think of ideas, dimensions and lists(to-do lists, and list of scores when driving).
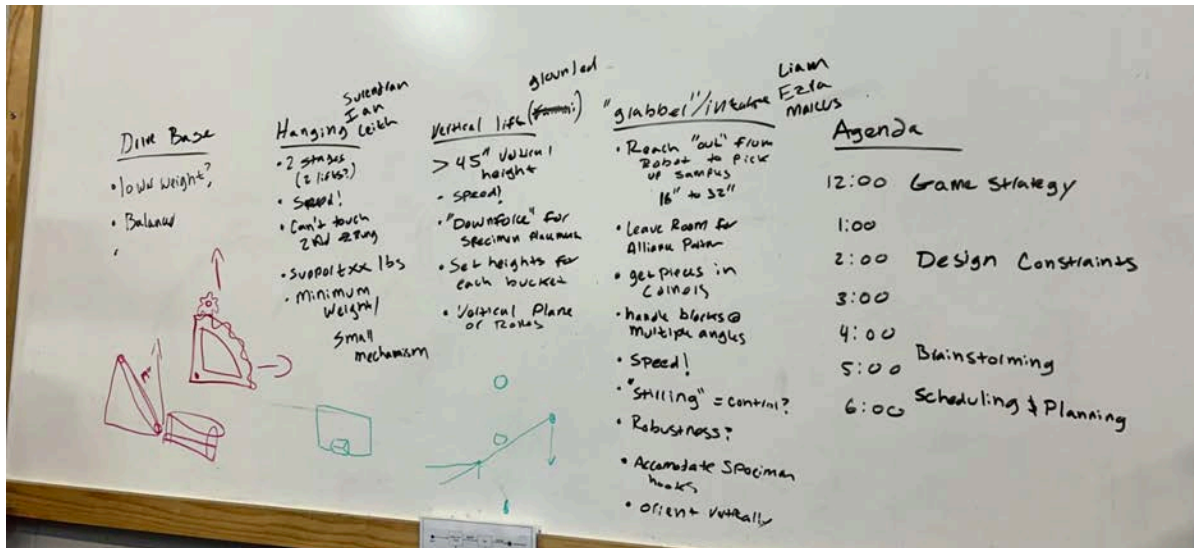
Drive Base

Brainstorm: From watching the game video we quickly realized that we would need a lot of space on the robot for all the requirements in the game. Also we would need a robot with a nice strong base to be able to sustain all the mechanisms that were needed.
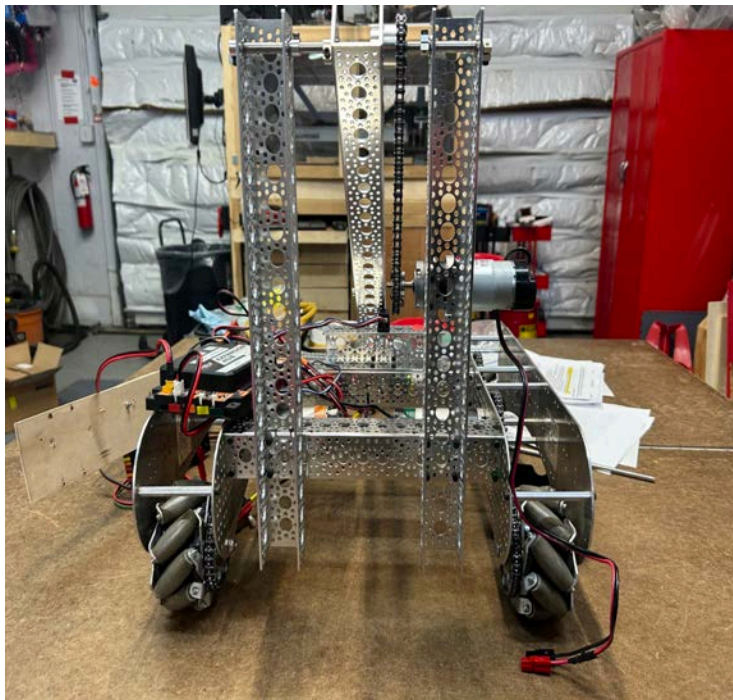

**Final Design**: We ended up reusing a similar drive base that we used during the 2021-2022 Freight Frenzy season. This allowed us to be able to have all the things we wanted in a drivebase while also not spending too much time building a whole new one. One major change that happened was we added 2 steel channels in the back of the robot to be able hold up the steel arm that we use for putting samples in the high basket.

Grippy!

must
be parallel
to specimen
When closed

3/8 in

Specimen grabber

# Specimen Mechanism

Design and strategize:

We decided to use separate mechanisms for scoring specimens, and scoring samples. This allows these mechanisms to be specialized, and our strategy can survive one or the other failing or becoming damaged during a match.

This is the original sketch for our specimen gripper. We went through a process of going through the game manual and rules, then brainstormed a mechanism that would most efficiently score the specimen.
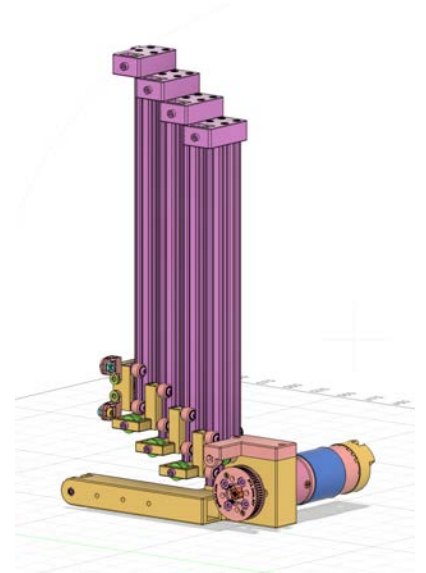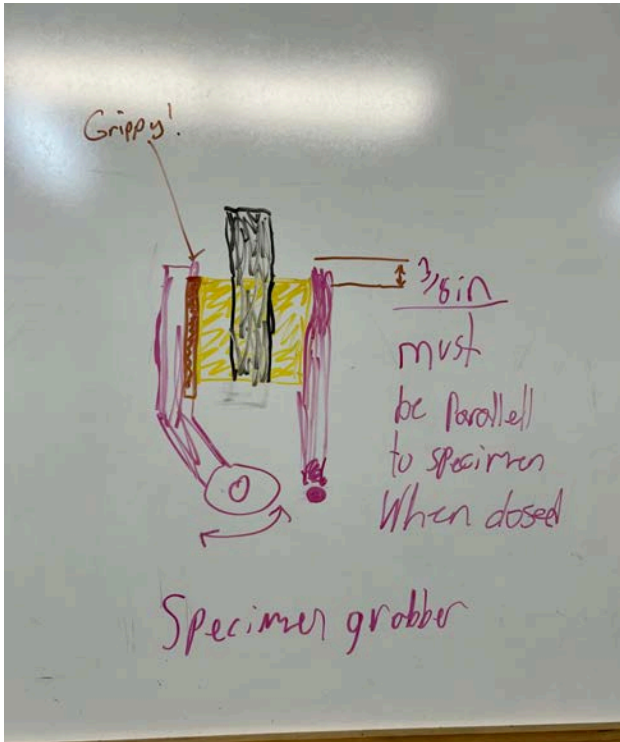
Final Design:



This is our final design for the specimen mechanism. We 3D printed a triangle part on one side of the gripper and a metal arm on the other side surrounded with foam tape. We did this so that we would have an accurate grip with the triangle but still have room for error with the foam grip side. The gripper works well and is able to pick up to hang specimens on the submersible bars effectively.
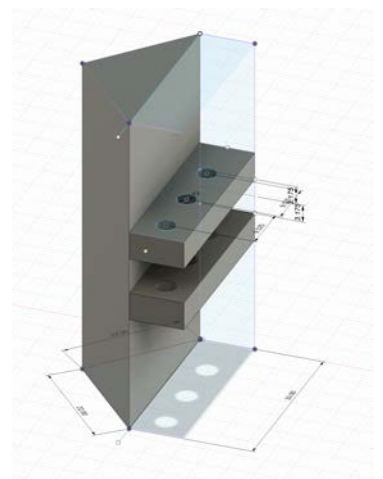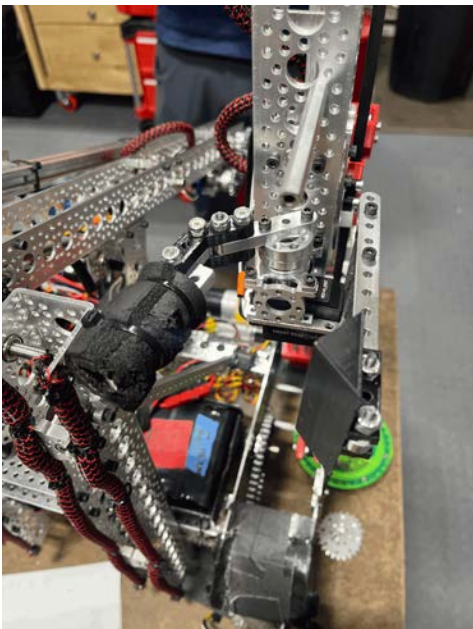
Intake and scoring mechanism
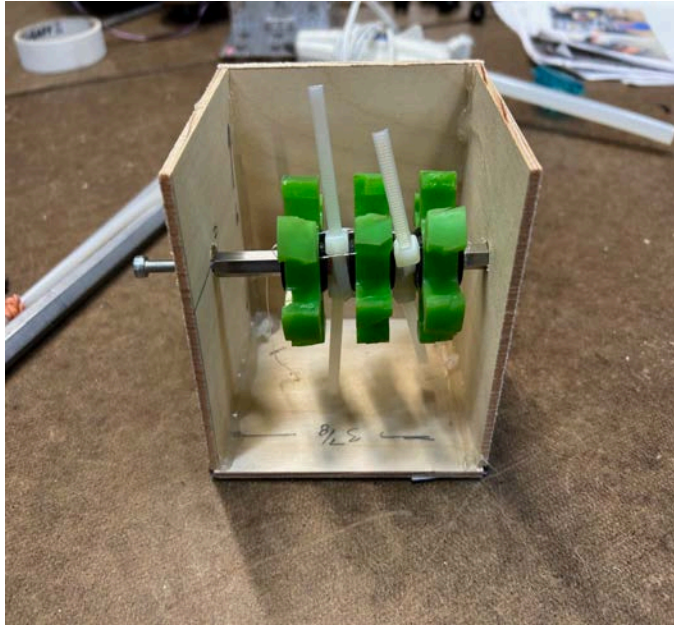
Brainstorm: Our team has a lot of experience using wheeled intakes so we naturally went in that direction for intakes this season. Although the idea was good at first the more prototyping and designing that we did we realized the problems with a wheeled intake. It was hard to get the wheels in the submersible and still be able to efficiently pick up the samples from different angles. We also struggled with trying to pick up the samples. With the wheeled intake although the pickup time was fast the wheels need to be directly on the sample to pick it up which isn't always the case.

Final Design: Through a lot of trial and error we ended up with a gripper for our final design. The gripper was much simpler and proved to be more efficient when picking up samples. It solved our problem of not being able to pick up samples unless directly touching the sample. The gripper does not have to be perfectly lined up with the sample to be able to pick it up, it can be at an angle or even pick the sample up horizontally.

The Forearm:

This is an attachment to the elbow of the robot. It is connected by a servo which is basically a joint that is able to move the forearm up to 190 degrees. The forearm allows us to reach the high basket as you can see in the photo, and allows us to reach into the submersible to pick up the samples
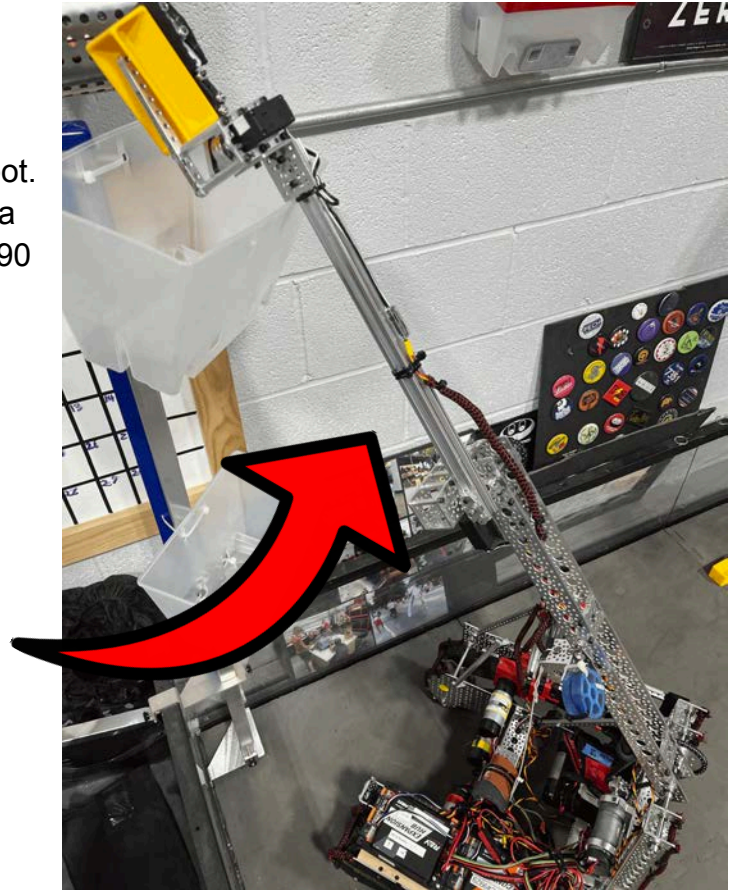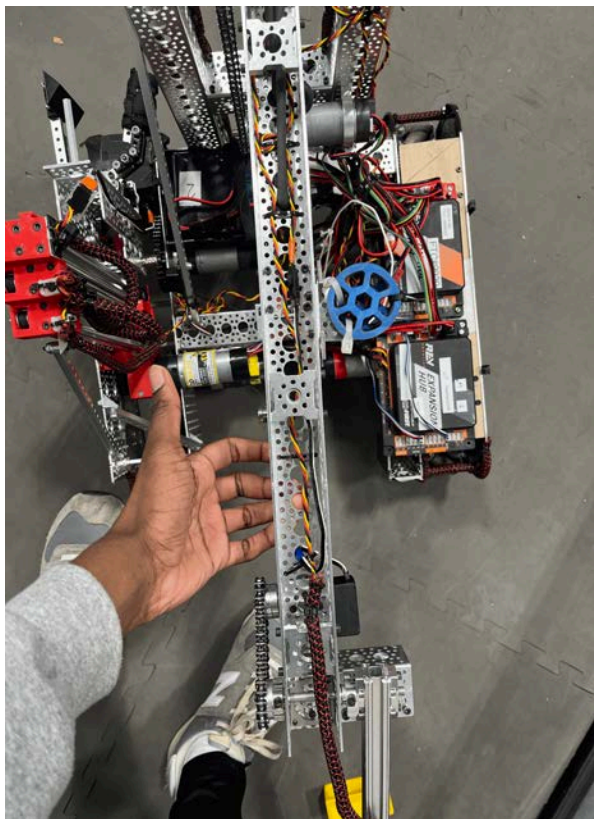
Shoulder:

The shoulder is controlled by a motor and has an oscillating motion. The arm is able to be raised up to allow our forearm to then also extend out to reach the high basket

Controls

We have been trying to make our robot run smoothly and can be understood easily! We have LEDs, and special controls to allow for the drivers to be able to be more ready.

LEDs are very aesthetically pleasing but can also be used to make sure the robot knows what autonomous it should run, it also shows when the endgame will start with a change of color.

Special controls also have an important part of our driving!
- Party mode is a feature that allows the robot to go full speed instead of being limited in its driving speed.
- Automated buttons can be seen throughout the operator's controller and help the operator by only needing to click a button to do a task that needs precision.
- The controllers have a feature called "Rumble" that allows for the driver and operator to know when endgame is about to start and when it actually does start.
- Throttle curves allow for our driving to start off a little slower and then get faster over time for better control when driving in tight spaces.
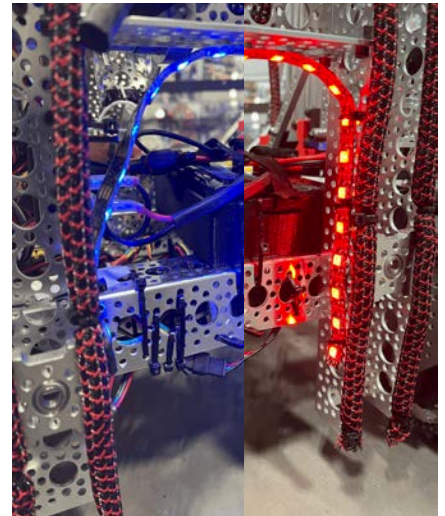
Code

- Throughout the seasons we have collected and made new code and with that code we store it in a library called GitHub. Our GitHub account is open to the public so teams can use our code to help their team. This season we used GitHub as a foundation for all of the code. We then made a separate folder and modified that code to meet this season's gameplay.
- We had a problem with the forearm slamming against the field and dragging against it which broke one of our servos in a league meet. While we made some mechanical fixes we also added a piece of code so that when the arm was in its down position the servo turns off which would limit the impact of how hard the forearm hit the ground which helps the drive team.
- We have been reusing code from over the years to allow for more build time without needing to worry about the code, this also helps us be ready for future competitions by having codes that can go with many different circumstances and mechanisms.

Making Connections

Website

The team has its own independent website. It
features pictures of events and meets, information about both the FTC FIRST program
and our team, some blog entries of things we have learned, and even past seasons'
Engineering Notebooks to serve as examples to new teams. We use the website to
reach out to potential sponsors and the community. Over 6000 people have viewed our
website and previous engineering portfolios in the past year.

GitHub – We share all our robot code with the world as we write it on GitHub

It is also on GitHub where we publish TntFtcCore, which is a
publicly available library of code available for anyone who wants to
use it. It was made as a legacy project by the senior programmers.
It consists of software produced over the multiple years the senior
programmers have participated in FTC. This software is designed
to make advanced tasks more reliable and easier to program. It
already has 100+ downloads per month

Instagram - We share updates on our robot and the team as a whole

We have recently begun to continue putting updates on our instagram
account. We have decided to put an introduction to our team on our
instagram account and we will add videos of our robot and its progress. We
will be able to connect with the world similarly to how other teams connect
with their community.
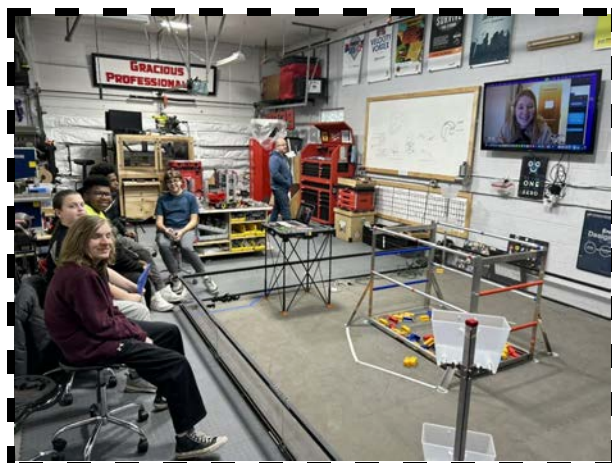
We have connected with a Purdue student in
Material Science Engineering. She used to be
a member of TNT so she was able to connect a
lot with things we use for our robot. We learned
a lot such as how steel is different from other
metals and when building things with metal,
metal needs to be planned out for the ideal
form that is needed. We are very grateful for
the wonderful experience.

Sustainability

This season we were fortunate to once again be awarded a grant from Schneider Electric.

We have a lot of costs that Schneider helped cover:

• Power Tools

• Robot parts and spares

 • Competition Registration

The Homewood Science Center has been invaluable to us for many seasons. They provide us with space to work and have introduced us to our two sponsors. We give back by volunteering at their events, which in turn helps us with STEM outreach. The Homewood Science Center allowed us to maintain access to our shop throughout the pandemic.

Being able to use the shop has been great because it allowed us to have access to our tools and have enough space for social distancing.

This year we have 1 new team member, Liam, who has quickly adapted to the Tech Ninja workstyle and has quickly become an invaluable member of the team.

 We have also been able to bring in 2 new mentors who have also become very helpful in learning new ways to think of solutions as well as being able to help us when building, programming or playing a match.